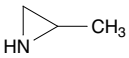
2-Methylaziridine

CAS No. 75-55-8

Reasonably anticipated to be a human carcinogen

First listed in the *Fourth Annual Report on Carcinogens* (1985)

Also known as propylenimine



Carcinogenicity

2-Methylaziridine is *reasonably anticipated to be a human carcinogen* based on sufficient evidence of carcinogenicity from studies in experimental animals.

Cancer Studies in Experimental Animals

Oral exposure to 2-methylaziridine caused tumors at several different tissue sites in rats. Administration of 2-methylaziridine by stomach tube for 28 or 60 weeks caused mainly mammary-gland cancer in females and leukemia in males. Increased incidences were also reported for cancer of the central nervous system (glioma) and ear canal (squamous-cell carcinoma) in both sexes and of the intestine (adenocarcinoma) in males (IARC 1975, 1999, Weisburger *et al.* 1981).

Cancer Studies in Humans

No epidemiological studies were identified that evaluated the relationship between human cancer and exposure specifically to 2-methylaziridine.

Properties

2-Methylaziridine is the simplest heterocyclic amine and is a reactive alkylating agent (IARC 1999). It exists at room temperature as a colorless oily liquid with an ammonia-like odor and is miscible with water and soluble in ethanol and most organic solvents (Akron 2009, HSDB 2009). 2-Methylaziridine undergoes violent polymerization on contact with acids or acid vapors and may explode. Physical and chemical properties of 2-methylaziridine are listed in the following table.

Property	Information
Molecular weight	57.1[a]
Specific gravity	0.812 at 16°C/4°C[a]
Melting point	–65°C[a]
Boiling point	66°C to 67°C at 760 mm Hg[a]
Log K_{ow}	0.13[b]
Water solubility	1,000 g/L[b]
Vapor pressure	112 mm Hg at 20°C[b]
Vapor density relative to air	2[a]

Sources: [a]HSDB 2009, [b]ChemIDplus 2009.

Use

2-Methylaziridine is used in the United States exclusively as a chemical intermediate, and its derivatives are used in the paper, textile, rubber, and pharmaceutical industries (IARC 1975, HSDB 2009). Because it easily forms imines, its primary use is in the modification of latex surface-coating resins to improve adhesion. Because of the substantive bonding of imines to cellulose derivatives, polymers modified with 2-methylaziridine or its derivatives have been used in the adhesive, textile, and paper industries. 2-Methylaziridine has been used to modify dyes for specific adhesion to cellulose, and derivatives have been used in photography, gelatins, and synthetic resins. In the oil-additive industry, 2-methylaziridine and its derivatives have been used as modifiers for viscosity control, high-pressure performance, and oxidation resistance. Other applications include use in flocculants in petroleum refining, as a modifier for rocket propellant fuels, in fiber modification, and in imine derivatives for use in medicinal and agricultural chemicals.

Production

In 2009, 2 methylaziridine was produced by one manufacturer in the United States and one in Europe (SRI 2009) and was available from nine suppliers, including six U.S. suppliers (ChemSources 2009). U.S. production of 2 methylaziridine was at least 100,000 lb in 1977, but had fallen to 5,000 lb by 1982 (HSDB 2009). Reports filed from 1986 through 2002 under the U.S. Environmental Protection Agency's Toxic Substances Control Act Inventory Update Rule indicated that U.S. production plus imports of 2 methylaziridine totaled 10,000 to 500,000 lb (EPA 2004). No other data on U.S. production, imports, or exports of 2 methylaziridine were found.

Exposure

The primary routes of potential human exposure to 2-methylaziridine are inhalation, ingestion, and dermal contact (HSDB 2009). According to EPA's Toxics Release Inventory, environmental releases of 2-methylaziridine between 1988 and 2009 ranged from a low of 89 lb in 2000 to a high of 1,482 lb in 2009. Nearly all of the releases have been to air, with small quantities (~5 lb per year) released to surface water or off-site landfills. In 2007, three facilities released a total of 1,482 lb (TRI 2009). If released to air, 2-methylaziridine is expected to exist in the vapor phase and can react with photochemically generated hydroxyl radicals, with a half-life of 1.6 days (HSDB 2009). If released to surface water or moist soil, it is expected to hydrolyze, with a half-life of 17.5 days. Although it can be mobile in soil, 2-methylaziridine does not leach into groundwater, because it degrades very rapidly. It may also volatilize relatively slowly from wet soil or surface water but relatively rapidly from dry soil.

Because of its volatility, occupational exposure could occur during production, packaging, or use of substances made with 2-methylaziridine (HSDB 2009). The National Occupational Hazard Survey (conducted from 1972 to 1974) estimated that 20 workers potentially were exposed to 2-methylaziridine in 1974 (HSDB 2009). The American Conference of Governmental Industrial Hygienists noted the potential for dermal exposure, including via the mucous membranes and eyes, by airborne or direct contact and have given 2-methylaziridine a skin designation (ACGIH 2009).

Regulations

Department of Transportation (DOT)

2-Methylaziridine is considered a hazardous material, and special requirements have been set for marking, labeling, and transporting this material.

Environmental Protection Agency (EPA)

Clean Air Act

National Emissions Standards for Hazardous Air Pollutants: Listed as a hazardous air pollutant.
Prevention of Accidental Release: Threshold quantity (TQ) = 10,000 lb.

Comprehensive Environmental Response, Compensation, and Liability Act

Reportable quantity (RQ) = 1 lb.

Emergency Planning and Community Right-To-Know Act

Toxics Release Inventory: Listed substance subject to reporting requirements.
Reportable quantity (RQ) = 1 lb.
Threshold planning quantity (TPQ) = 10,000 lb.

Resource Conservation and Recovery Act

Listed Hazardous Waste: Waste code for which the listing is based wholly or partly on the presence of 2-methylaziridine = P067.
Listed as a hazardous constituent of waste.

Occupational Safety and Health Administration (OSHA)

While this section accurately identifies OSHA's legally enforceable PELs for this substance in 2010, specific PELs may not reflect the more current studies and may not adequately protect workers.

Permissible exposure limit (PEL) = 2 ppm (5 mg/m^3).

Guidelines

American Conference of Governmental Industrial Hygienists (ACGIH)

Threshold limit value – time-weighted average (TLV-TWA) = 0.2 ppm (0.5 mg/m^3)
Threshold limit value – short-term exposure limit (TLV-STEL) = 0.4 ppm (1 mg/m^3)

National Institute for Occupational Safety and Health (NIOSH)

Recommended exposure limit (REL) = 2 ppm (5 mg/m^3).
Immediately dangerous to life and health (IDLH) limit = 100 ppm (250 mg/m^3).
Listed as a potential occupational carcinogen.

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